CHEMICALS

Project Fact Sheet

Two-Step Methane Conversion to Alkynes and Dienes

Benefits

- Reduces energy requirements by up to 45%
- Reduces electricity requirements by up to 500 Btu per lb. of acetylene
- Decrease solid, liquid and gaseous waste generation by up to 3 lb. per lb. of acetylene

Applications

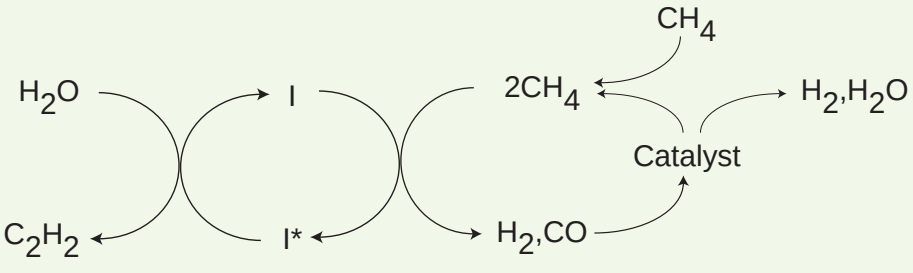
The primary application of this technology is the conversion of natural gas to high-purity acetylene.

New technology for acetylene production from natural gas decreases waste and energy requirements

Existing technologies for the production of acetylene and ethylene via the direct conversion of natural gas, such as non-oxidative and oxidative pyrolysis, as well as oxidative coupling, suffer from high utility and/or feedstock requirements and low product yields. In addition, pyrolysis-based processes generate dilute concentrations of acetylene and ethylene in the reactor effluent, thus necessitating energy-intensive and expensive downstream separation steps. Product yields are lower than the theoretical limits because intrinsic chemical kinetics and thermodynamic equilibrium result in a broad product distribution, and because ethylene and acetylene can rapidly decompose to coke and oligomerize to aromatics at the elevated temperatures employed by these technologies. Consequently, there is a need for a more energy efficient process that selectively converts methane to acetylene and/or ethylene at moderate conditions.

Project partners are developing a new technology that generates high-purity acetylene from natural gas through a series of multiple, but interdependent, process steps. In this process, methane is contacted with a reagent to form an intermediate compound, which is subsequently reacted with water to generate acetylene. The produced carbon monoxide is internally recycled via conversion to methane. The technology is also suitable for propadiene production. Since acetylene and propadiene can be converted to ethylene and propylene, respectively, through commercially available hydrogenation technology, the process technology under development also has the potential to provide the U.S. chemical and petrochemical industries with an alternative method for the selective conversion of natural gas to ethylene and propylene.

CH_4 Conversion to C_2H_2



Schematic of the chemistry employed by the developed technology for the production of acetylene from natural gas.

Project Description

Goal: The goal of this project is to develop a novel technology for the conversion of natural gas to acetylene and hydrogen that reduces feedstock consumption, electricity requirements, and waste generation, relative to that of existing technologies.

Progress and Milestones

Early stage research resulted in the following key finding:

- Specific reagents exist that react with methane to yield intermediate compounds that selectively generate acetylene when subsequently reacted with water.

Current research is focused on achieving the following milestones:

- Optimization of the composition and structure of the reagent.
- Measurement of the intrinsic kinetics of each chemical reaction in the process.
- Design, operation and optimization of small pilot-scale reactors for each reaction in the process.

Commercialization

CeraMem Corporation currently has a nonexclusive, contingent agreement with The Carbide/Graphite Group, Inc. (Louisville, KY) to evaluate the technology and its potential market value.

Project Partners

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The Carbide/Graphite Group, Inc.
Louisville, KY

R.C.Costello & Associates, Inc.
Redondo Beach, CA

James W. Bunger & Associates
Salt Lake City, UT

Oak Ridge National Laboratory
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